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ABSTRACT

This lecture recounts personal experiences and discusses environmental issues that invoked a desire to teach about the things threatening the earth. Human population growth is cited as the first and foremost environmental challenge in the 20th century. A J-shaped curve is used to illustrate an increase in human population. The relationship between population growth, the human appetite to consume the earth's resources and the intensification of pollution problems is cited. Other related problems include water resource feuds, energy source depletion, contamination, greenhouse effect, and climatic changes. These problems are explained and illustrated with specific incidents of environmental conflicts. Oil resources are referred to as one of the most important issues of the next decade because of its close tie with the economic well being of the United States. The use of non-polluting renewable energy sources and further study are encouraged to allow for a better understanding of our relationship to the natural world and to foster sustainable systems. (Contains 14 references.) (MCO)

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TOWARD A SUSTAINABLE FUTURE

RANCHO SANTIAGO COLLEGE
THIRD ANNUAL FACULTY LECTURE

BY RICHARD D. BATES

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RANCHO SANTIAGO COLLEGE
THIRD ANNUAL FACULTY LECTURE

TOWARD A SUSTAINABLE FUTURE

By
Richard D. Bates

November 15, 1989
Phillips Hall

You must teach your children that the ground beneath their feet is the ashes of our grandfathers. So that they will respect the land, tell your children that the earth is rich with the lives of our kin. Teach your children what we have taught our children — that the earth is our mother. Whatever befalls the earth, befalls the sons of the earth.

This we know. The earth does not belong to man; man belongs to the earth. All things are connected like the blood which unites one family.

Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself . . .

Chief Seattle

We live in a world of complexity and sophistication that has never been equalled in the history of mankind. I am a product of the wonders of medical technology, and I am appreciative to be living in this day and age. About six years ago I suffered a major heart attack, and it was through intervention by a skilled medical team that I was able to survive the night. The life-saving procedure which stopped the effects of my heart attack that night was a relatively new technique that had only been in use for about a year. Subsequently, I underwent an intricate open heart operation that rechanneled blood to damaged heart muscle. Through the surgery, and other types of medical interventions, I have had six symptom-free years in which to continue my life's work.

Since that experience, I have not looked at life in the same way. My feelings have become more intense, and my opinions more explicit. My primary ambition in life, outside of devotion

to my family, has been one of love of nature and concern for the environment of the earth and its inhabitants.

This interest began many years ago when I was a young man participating in family outings, and progressed through college and graduate school. Many important lessons of life were gleaned while doing ecological research on a small mammal for three summers in the Rocky Mountains of eastern Utah. Often I would do my observational studies with a pair of binoculars, sometimes on a high mountain, and other times within the solitude of a forest. While involved in this post-graduate work, I made a decision to spend as much time in my life as possible studying nature and sharing the knowledge of the natural world with others. As a result, our family has traveled extensively in the West, and during the past seventeen years I have taught over sixty extended field biology classes in the western states. I have bequeathed upon my students both knowledge of living systems as well as an appreciation and respect for the natural world in which they live.

After experiencing nature first-hand for long periods of time, people have a renewed outlook on their life. John Muir, an outstanding nature writer, after spending much of his life in the mountains, wrote:

"Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like autumn leaves."

I have experienced these same feelings on numerous occasions while in remote mountain or desert areas, as have many of my students. Here are accounts of journal entries from two of my former students. The first is from a young lady who, after experiencing a week in the High Sierras wrote:

"On the last night of the trip I decided I needed to be alone for awhile, so I left the group and walked over to the stream where we had been that morning. There was a little wooden bridge that I crossed, and the flowers on the other side were gorgeous. I spent some time lying on my back in the grass next to the stream, and then I went up to the top of a hill where we had been that morning, and I looked out across that valley to the granite slopes with pine trees on the other side. This was very peaceful. I enjoyed being alone and communing with nature. This was the best experience of the whole trip for me."

Another young man wrote of his feelings after spending several days in a remote wilderness area of the High Sierras.

"I think the most important thing I learned on this trip is that nature must be appreciated and respected. If man is to continue living on this planet, he must realize that concept. A trip to the woods should be more than a fun vacation. It may also be a valuable learning experience. Yosemite is rich in geological and natural history. It is a gateway to the discovery of the earth's

origin. When we learn something about the natural history of our planet, we learn a lot about ourselves also. Roaming through nature we discover a certain harmony, and a peaceful solitude found nowhere else. Discovering that peace we also find another kind of harmony—the one that dwells within ourselves. When one finds that inner quiet, he can realize his true place in the world."

Albert Schweitzer once wrote:

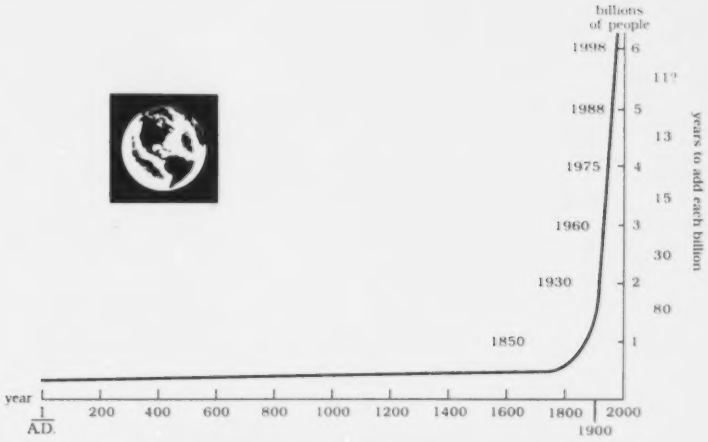
"Let a man once begin to think about the mystery of his life and the links which connect him with the life that fills the world, and he cannot but bring to bear upon his own life and all other life that comes within his reach, the principle of reverence for life."

I believe one of the important things each of us needs to discover in our lives is our true place in the natural world. Once a person has that awareness, he/she will work to protect the earth and its inhabitants from sacrilege.

For the past fifty years, our species has achieved a greatness known in no other time in history. We have made great accomplishments in the sciences, medicine, industry, engineering, the arts, and humanities. However, as we enter the last decade of the 20th Century, we hear of disturbing events that are happening in our natural world. Newspaper, magazine, and television stories are written that discuss subjects such as disposal of toxic wastes, availability of clean water, the quality of our air, erosion of our topsoils, acid rain, drought, future energy resources, destruction of wildlife habitats, and even alterations of the climate of the earth! These issues result from the direct effects of increased human population and its insatiable appetite to consume the earth's resources.

As a scientist I would like to discuss some of these topics with you, and apprise you of possible outcomes that may affect us all in the years to come.

The first and foremost environmental challenge we face is human population growth. Since the early 20th Century, human population throughout the world has grown exponentially. Even though two major world wars have occurred in this century, and famine and pestilence have befallen the human family, our population has grown from about 1 billion at the beginning of this century, to about 5.3 billion today. Future projections forecast increases to over 6 billion by the early 21st Century. Once the population has begun this rapid acceleration it takes an increasingly shorter time period to add additional billions of people. What does this increase portend? As the number of human beings increases, more and more demands are placed on the earth's resources — resources such as energy, soil, forests, clean air and water, and adequate living space. Today, in many parts of the world, the earth is showing the strain of too many people in its fragile environment. Numerous overtures have been made to Third World nations to curtail



J-shaped curve of the world's population growth

their burgeoning populace, but with ineffectual results. In the United States, our population growth has slowed in recent years, but we still consume a disproportionate share of the earth's vital resources (U.S. has 5% of world population, but consumes 33% of world petroleum resources and 36% of other basic commodities). Increasingly in the future, many of our basic resources will be imported from foreign nations. Our increasing resource consumption will become more costly and also intensify existing pollution problems.

In the United States today, air pollution is threatening our health. Sixty percent of Americans live in cities that do not meet health standards established by the federal Clean Air Act of 1970. Our air here in Southern California is the poorest quality of any in the United States. Annually it costs us over $9 billion in health effects alone. A recent study released by the South Coast Air Quality Management District reported that 98% of Southern Californians are breathing unhealthful amounts of ozone, the major ingredient of smog. A twenty-year sweeping plan proposed by the SCAQMD would have us use cleaner fuels (such as alcohol) in 40% of our motor vehicles within ten years, and electrification of all our cars, trucks and busses within twenty years, curtailment of future population growth in our communities and increase smog controls in industries. This plan has been criticized by business leaders, politicians and others as stifling our economic expansion. A recent economic report projects that Orange County alone will have over 385,000 new jobs created in this coming decade, adding even more to our air pollution burden. In addition to the health hazard to all of us living in Southern California, smog is affecting such natural

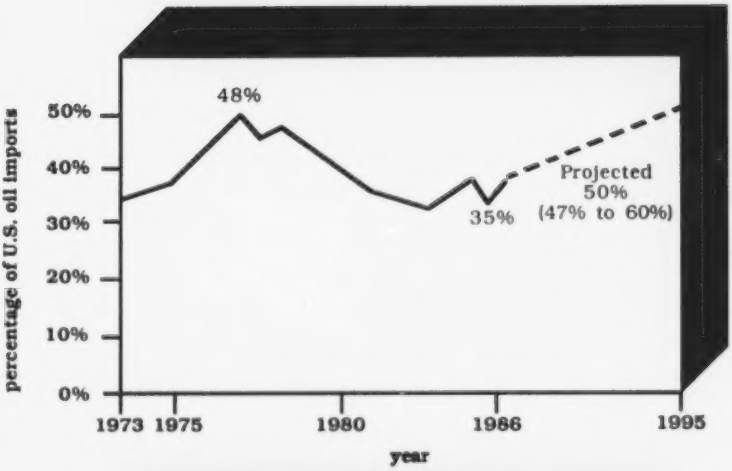
areas as the forests of Sequoia National Park, desert flora of Death Valley and ecosystems in neighboring southwestern states.

On our annual biology fieldtrip this past summer into the Southwest, the last night's camp was on the south rim of the Grand Canyon. Our group had spent the day traveling across northern Arizona, and was scheduled to arrive at our campsite about dusk. As we approached the Grand Canyon from the east, the pace of our travel quickened as we ascended the Coconino Plateau which makes up the southern rim of the canyon. Just before sunset, we reached the first viewpoint overlooking the immense chasm. Students eagerly sprinted from the vehicles, and ran to photograph the canyon sunset. Then came the shock. The canyon was filled with smog! One of the class members remarked disappointingly, "This looks just like Southern California." Disillusioned class members climbed back into the vans and the mood was that of silence as we drove through the gathering darkness to our campsite. In the morning the canyon, although somewhat obscured, was clearer than the previous evening. Photos were taken, and a lecture was given, but for most of the students the elation was gone. Even the Grand Canyon had smog! But from where? First, from the exhaust of thousands of automobiles that travel the canyon rim each day. Secondly, air pollutants blown in from Southern California and Arizona. Third, from the emissions of a nearby coal-burning electrical generating plant—ironically which generates electricity for the Los Angeles area. Yes, even the air of our most beautiful and majestic canyon is polluted.

In Orange County, what are future plans to reduce or remove air pollutants from our unclean skies? Our government's response is to build a series of new freeways and widen existing ones, which will allow additional motor vehicles to pollute the air even more. There is an ongoing resistance in our communities to drive more fuel-efficient automobiles, and a reluctance to develop rapid transit systems, that would ease our traffic burdens, conserve our valuable oil resources, and clean our air.

Another pressing problem that results from rapidly increasing population in Southern California is water resources. Today about 70% of these resources are imported from outside our general area. For nearly ninety years, Southern California agencies have been diverting water from other environments and peoples, both in California, and elsewhere in the West. Starting with the construction of the Los Angeles Aqueduct into the eastern Sierras early in this century, then with the completion of the Colorado and California Aqueducts, and the All-American and Coachella Canals in the southern desert, water has been brought into Southern California for both agricultural and urban use. There are many who desire to see these uses continue unabated. But people, governments, and economic pressures outside of Southern California have thwarted our continuing efforts to usurp our unfair share of a resource which

is vital to all people and economic development in the arid West. Recent court decisions in California have prevented the total diversion, by the city of Los Angeles, of fresh water streams that feed Mono Lake. Vigorous opposition by northern California citizen groups and governments has prevented the construction of the Peripheral Canal, which would siphon off more water to Southern California. The completion of the Central Arizona and Central Utah Projects, and increases in Indian and Mexican water rights have reduced Southern California's allocations from the Colorado River. Water, a vital and precious resource for all of us in the dry western states, is important to the future growth of all the West, not just Southern California.



Percentage of U.S. Oil Imported 1973 - 86
with Projections to 1995

As we near the end of the 20th Century, we also approach the end of an energy era in our history, that is the use of oil as our primary energy source. At the beginning of this century, our principal energy resource was coal. With the discovery of oil fields in such places as Pennsylvania, Texas, and California, and with the advent of the automobile, and other modern modes of transportation, we began to use oil with unabating vigor. In the mid-1970's we reached peak oil production in the United States, and began to depend more and more on imported oil. Events in the Middle East in the 1970's caused interruptions of these imported supplies, and resulted in two oil crises. During the early 1980's our consumption declined, as did our dependence on imports. However since 1986, as our consumption patterns once more increased, imports began to gradually rise. Presently our oil imports are about 40%, and there are some who project this to be about 50-60% by 1995.

Buying oil from foreign countries is a drain on our economy, and invites further disruptions in our supplies. Most of these foreign sources are in the Middle East. Libya, for instance, has as much oil reserves as the United States. Iran and Iraq both have twice our reserves, and the countries of the Arabian Peninsula have ten times our known assets. Unless we find a replacement for oil, or begin substantial conservation programs, we

will have to live with this complex, and portentous situation throughout our lifetime as will those of our posterity. By the early 21st Century, we must find new energy alternatives.

Solar, wind, geothermal, biomass and co-generation are all non-polluting renewable energy sources that can come on-line fairly rapidly, and do little to pollute our environment. Increased energy efficiency can be realized in our transportation systems, industries, and buildings, and is a logical and sensible way to protract our declining oil reserves. For instance, if we were to improve our automobile efficiency by only three additional miles per gallon, we could eliminate our imports of oil from the Middle East. One of the most important issues of the next decade will be to employ strategies to economize our oil resources, which are closely tied to the economic well being of our country.

As the pollution of our earth has increased, more and more areas have been contaminated. Today there is evidence that we are altering the very climate of the earth through our many endeavors. Two often discussed problems are the ozone layer and the Greenhouse Effect.

Our earth is sheltered from excess solar radiation by the ozone layer, a thin layer of gases in the stratosphere that shields the earth and its inhabitants from the damaging effects of ultraviolet light. Certain chemical substances that contain chloroflorcarbons (which originate mainly as propellents, or are used in refrigerators and air conditioners) are primary contributors. Research over the past several years has indicated that our protective ozone layer has been reduced, and that fairly large holes have developed over both the Arctic and Antarctic areas. Today many states, and nations are banning the use of substances that tend to deplete our protective ozone layer. Increased use of solar and wind energy systems will also lessen ozone-reducing combustion products in our atmosphere, and provide us with needed electrical energy for the future.

The planet we live on is vast. Its land areas encompass over 60 billion square miles of surface area, and includes jungles, deserts and expansive arctic areas. For hundreds of years we have explored the earth's lofty mountains, its ocean depths, and deep canyons. The last area of exploration is its atmosphere. Today weather satellites circling high above the earth monitor conditions in the atmosphere. The movement of great air masses can be detected thousands of miles away. Accurate weather forecasts can be determined from data derived from these satellites.

Although we are quite accurate in forecasting short-term weather changes, we have a limited knowledge of the earth's climatic variations. Evidence from dendrochronology, the science of tree rings, indicates that in past history there have been periods of hot, dry conditions interspersed with cool moist ones. The reasons for these fluctuations are unclear, but theories have included increased glaciation, large volcanic eruptions,

and cyclic sunspot activity.

There is fairly strong evidence from the scientific community that the earth's atmosphere is now in a warming trend. The reasons for this are surmised to be due to increasing amounts of carbon dioxide gas, and other types of greenhouse gases that result from combustion and other human activities. These greenhouse gases tend to slowly increase the temperature of the atmosphere, which could create long-term effects such as the melting of polar ice masses (thus raising the levels of the earth's oceans), gradual desertification, shifting of present agricultural regions and other environmental impacts. Temperature increases would be gradual and extend over many decades. Once these climatic changes are set in motion, they would be longlasting and difficult to reverse.

The primary reason for increases in atmospheric carbon dioxide is industrialization. For the past one hundred years, nations of the world have been increasing their use of fossil fuels such as coal, oil and natural gas. Carbon dioxide produced from the combustion of these fuels has increased the overall temperature of the atmosphere. Other combustion byproducts and varying man-made chemicals have also been identified as greenhouse gases. Deforestation and certain farming practices have also been linked to increases in concentrations of these gases.

In order to maintain steady-state atmospheric temperatures, scientists have urged the reduction of fossil fuel consumption, and their replacement with non-polluting alternatives, better emissions control, and a reduction in deforestation practices. These actions taken today will provide a more favorable climate for our descendants.

In the field of environmental science there is a principle called the Sustainable-Earth Principle. This tenet avows that the earth's air, water, and other essential resources and economic systems must support both our generation and future societies in a way that will provide reasonable economic gain as well as control pollution and the continued degradation of our planet. This would allow our descendants to enjoy the same quality of life, chance for fiscal growth, and the continuing availability of the earth's natural resources as we have had.

The earth has been our home for thousands of years. Famine, pestilence, and disease have scourged our numbers on occasion. Still this planet has provided us with the necessities of life. It is our solemn responsibility to future generations to prevent the continued plundering of our natural resources for short-term financial gain. We must halt the subversion of the earth's life support systems we are all dependent upon. We need to better understand our relationship to the natural world we are part of, and to exercise a stewardship over our land, air and water so that our descendants may flourish on this beautiful planet.

These efforts must begin in our local communities, spread

across our nation, and travel throughout the world. Recently there has been an easing of tensions between the United States and the Soviet Union. With this increased trust and compatibility between our nations, it is hoped that both the expertise of our scientists and the redirection of our financial resources that have long been committed toward destruction will be mutually used to improve the common environment of us all.

I call upon you as educators in the science, arts, and humanities, as students, and as good men and women everywhere, in joining me in this quest—to exhibit an inveterate stewardship over the earth and its life perpetuating systems, and to convey to our posterity the sense of wonder, awe and majesty of our diminutive home in the vastness of the cosmos.

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RICHARD D. BATES

Richard Bates was born in Salt Lake City, Utah in 1939 and grew up in that northern Utah city. In 1964 he graduated from the University of Utah with a B.S. degree in biology. After teaching high school for three years in Utah and California, he returned to graduate school at Brigham Young University, and completed his M.S. degree in zoology in 1969. While at BYU he was a part-time faculty member, and participant in Sigma Xi, the biology honorary society.

Mr. Bates taught for two years at the University of Wisconsin and was the coordinator of the Audio-Tutorial Biology Program at that institution. While there he received a two-year grant from the National Geographic Society to conduct ecological research on a small alpine mammal called the pika. During this period he was also a participant in a National Science Foundation sponsored institute on mountain ecology held at a Colorado State University field station in the Rocky Mountains.

Mr. Bates then moved to California and taught as a sabbatical leave replacement for a year at Diablo Valley College in Concord, California. He joined the faculty at Rancho Santiago College as a full-time instructor in the fall of 1972. In addition to his teaching duties, he has developed a number of new biology and environmental science courses and helped to establish RSC's Energy Technology program. In the last 17 years he has taught over 60 field biology classes in every western state. His field work has also included desert biology courses taught through the University of California-Irvine Extension. While at RSC he served as the Department Chair in Life Sciences from 1976 to 1986, and has developed the laboratory programs in both General Biology and Environmental Biology.

In 1984 he suffered a major heart attack. Upon his subsequent recovery he served as a volunteer with the American Heart Association and with Mended Hearts, a support group for those who have undergone open heart surgery. Also, he founded Hereditary Hearts for others like himself who have hereditary heart disease. Here in Orange County he was instrumental in the formation of a task force sponsored by the Orange County Department of Education to institute cholesterol screening programs among elementary school children. He is currently serving on a committee consisting of physicians and health care professionals at CHOC and UCIMC for the establishment of an Orange County Family Lipid Clinic. He is also working in conjunction with the University of Utah Cardiovascular Genetics Clinic to locate distant members of his family who suffer this same hereditary disease.

Mr. Bates resides in Santa Ana with his wife Anita, an elementary school teacher in Orange Unified School District, and his three children. His two daughters attend Brigham Young University, and his son is a student at Santiago Middle School. Last May he received the college's third Annual Faculty Lecturer Award.

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